

NEW BEES AND WASPS—PART VII

Two Undescribed Species of *Exoneura*, with Notes on Recent Collectings of several other *Exoneuræ* and the Extraordinary Appendages of Their Larvæ

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Introductory

I have a correspondent, Norman W. Rodd, a chemist who is also an indefatigable collector of the native bees. Facing his home at Lane Cove, near Sydney, is a gully, steeply walled, with masses of the ubiquitous sandstone flung hither and thither as though broadcast with careless prodigality by some gigantic hand.

In this gully is found the typical xerophytic flora of the Sydney sandstone areas: a wattle or two; nodding blue-bells; beard-heath (*Leucopogon*); *Scaevola*; *Dianella*; *Olearia*; *Banksia*; *Correa*; *Epacris*; and, indeed, most of the other genera typical of such areas.

In these retreats, untouched by modern housing schemes, the collector finds many indigenous bees, for he is eager to assist in unravelling the story of *Exoneura*. He clambers down the gully, breaking off any likely looking sticks in the hope of finding yet another "nest." Of course he is rewarded, for he discovers in small dry twigs of wattle, *Lantana* and *Erythrina* "nests" which hitherto were unknown to science.

Well, the collector is elated by his success, for he finds adults, "nests," and larvæ, also other species at Lindfield, which is near the extreme head of Middle Harbour, and Brooklyn, near the Hawkesbury River, all these localities being in New South Wales.

Two of Mr. Rodd's collections proved to represent new species, and I propose the following names and append the specific descriptions. The short notes on other bees, together with the drawings of the larval forms, will assist the student in recognizing these extremely interesting but, nevertheless, critical species.

Exoneura angophorella, sp. nov. (Fam. Ceratinidae)

TYPE: Female—Length, 6 mm. Black head and thorax, red abdomen.

Head transverse, shining, but with a well-defined microscopic tessellated sculpture, and large punctures; anterior orbital margins converging slightly below; clypeus with the cross-bar of a hooked "T" above, and a wide suffused bar of yellow along the anterior margin, a small yellow dot laterally; front of the scapes ferruginous; labrum reddish; mandibles black with a median red patch, and a small yellow patch basally.

Mesothorax shining, but tessellated, sculpture still evident; considerable white plumose hair on the pleura; tubercles black, with a thick fringe of white hair; tegulae apricot colour, as are all the axillae.

Each segment of the reddish-ferruginous abdomen has a band of diffused blackish colour.

Legs ferruginous, with very distinctive black posterior tibiae and tarsi with black hair; median tarsi dark with coppery hair. Wings with nervures sepia, and pterostigma dark umber-brown.

Locality: Lane Cove, Sydney, October 6, 1946. In stems of *Lantana*.

Approaches *E. hackeri* Ckll. and *angophorae* Ckll., and more definitely *albolineata* Ckll.

By the larvae appendages there is some relationship to *E. roddiana*; there is a like lack of "fingers" but there are *two* slender arms, and no nodes along the segments of the abdomen.

Exoneura sub-baculifera, sp. nov.

TYPE: (in the collection of the author): Female—Length, 6.5 mm. Black head and thorax, red abdomen.

Head oily-bright with a tessellate sculpture; face deeply excavated around the bases of the scapes; clypeus with a yellow "T" with a thin stem; scapes obscurely red in front, flagellum black; labrum obscurely reddish; mandibles black.

Mesothorax shining, but with tessellate sculpture still evident; much white hair on pleura; tegulae blackish; tubercles black.

Each segment of the abdomen with a band of suffused dusky colour (as in *angophorella*, but abdomen darker red); a microscopic rather coarse lineation, and numerous short stout hairs almost like peg-hairs.

Posterior legs red, with much long black hair which also covers the hind tarsi; other legs mostly reddish, with some black on the femora. Nerves and pterostigma reddish.

Locality: Lindfield, October 5, 1946. In stems of *Erythrina*.

In the absence of the larvae, this species, and also *E. angophorella*, would most certainly be determined as *angophorae*. Indeed, it would now appear to be unwise, in the absence of larvae, to describe as new *any* specimens in the group.

The large teat-like protuberance on the head of the larvae is indeed remarkable, and is an extreme development of the cephalic nod of *E. baculifera* Ckll.

Rodd suggests that the unique appendage of the larvae may be an exudatorium, such as are present on certain ant larvae, i.e. *Pachysima latifrons*, the adults of which lick off an exudate from the appendages, and appear to enjoy such lipoids, for ant larvae are known to exude fatty substances. Rodd thinks that even the male *Exoneura* may receive some of the exudate, and this may account for the presence of so many males in the nests of the species with appendages, and none in the nests of bees, the larva of which are without such exudatoria.

So far, I have not been able to study exhaustively the appendages of the *Exoneurae*. Dr. Hans Brauns, too, observed the larvae of

one group of *Allodape* to hold the pollen-pudding between what Friese terms the "pseudopodia," and Wheeler himself prefers this term, and says that the "arms" of *Allodape ceratinoides* hold the pudding to the buccal parts. Holmgren suggested that the several castes in certain ant colonies may be due to "exudate hunger," i.e. food castration.

When examined critically, the appendages of the *Exoneuræ* suggest pseudopodia rather than exudatoria, and I would say they are analogous, but not homologous, with the "legs" of caterpillars, since both are derived from the three thoracic segments. The teat-like protuberance on the head of the larvae may, however, prove to be an exudatorium as Rodd claims.

Exoneura roddiana normani, subsp. nov.

A series of adults of both sexes, reveals a subspecies with the red legs deeply suffused with blackish or even all black; clypeal stripe subobsolete, or even obsolete, giving an entirely black face; pterostigma blackish. Male more typical, but yellow of face brighter. Larvae and pupae are typical, the latter having one slender "arm" but no "fingers."

Locality: Lane Cove, Sydney, November 20, 1946.

TYPE and ALLOTYPE in the collection of the author.

New Records of Other Species and Description of Male
E. excavata

1. *E. albolineata* Ckll. (described from Ulong, Dorrigo, N.S.W.)

*New record*¹: Lane Cove, Sydney, October 5, 1946.

A series of females and larvae in a stem of *Lantana*. The cream-coloured clypeal mark has hooked extensions above; the coxae are black, femora only partly black, tibiae and tarsi red; pterostigma sepia. The larvae have one lateral appendage, bifurcate, with one very large basal "finger" and the three apical nodes developed to same length—a varietal form.

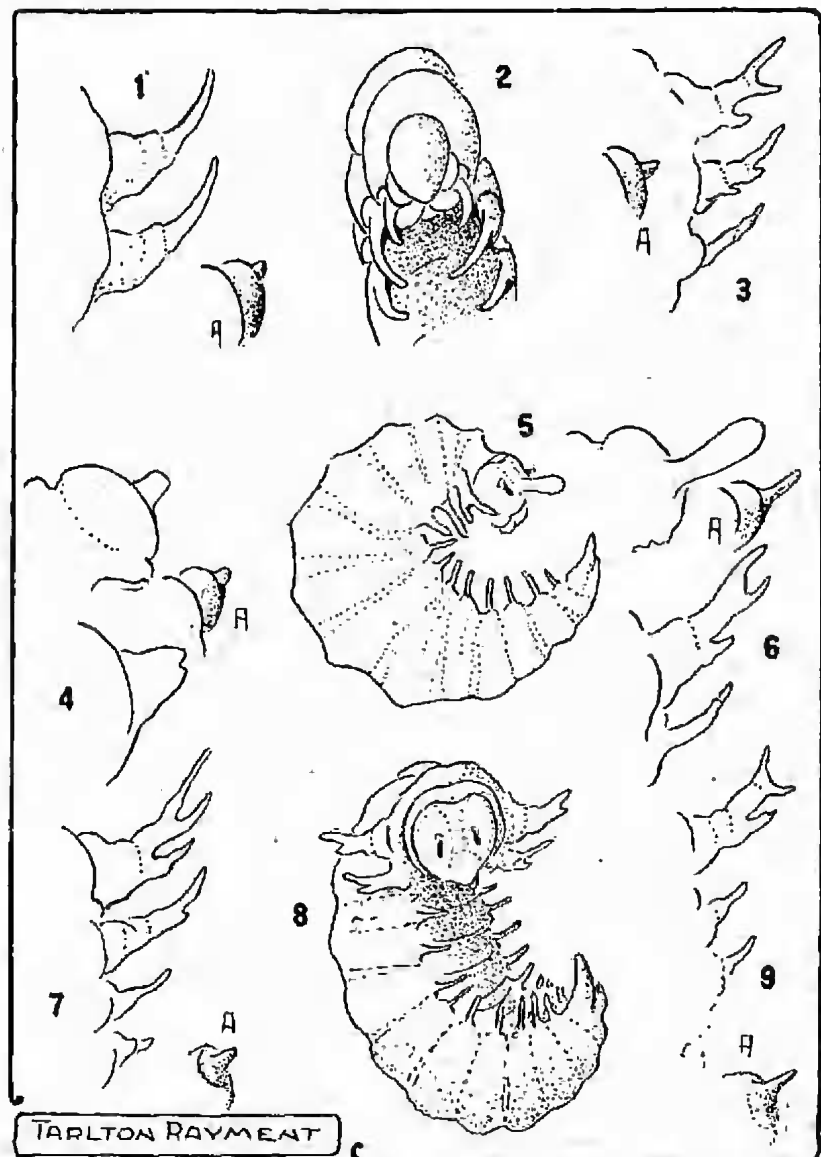
*New record*²: Brooklyn, N.S.W., October 7, 1946.

A series of females, and larvae in a stem of *Lantana*, not typical, but no more than varietal forms, for the clypeal mark varies widely; indeed, one or two females have a subobsolete stripe, and others a bright-cream "T" on the clypeus. The lateral face-marks may be long or reduced to mere creamy spots, and one female had an entirely black excavated "face." The larvae, however, are all typical.

2. *E. angophorae* Ckll. (described from Como, Sydney—Alex. Holmes)

New records: Lane Cove, Sydney (July 1946). Lindfield, Sydney (October 3, 1946).

A series of females and larvae in a stem of *Erythrina*. The clypeal mark is very variable, being a bright stripe of cream, a



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1, Lateral processes of *E. ungophorella*, sp. nov. 2, Diagonal ventral view of apical processes of *E. albolineata*, variety. 3, Lateral processes of *E. hamudata*, Ckll. 4, Cephalic node, and rudimentary lateral appendage, of *E. baculifera*, Ckll. 5, Lateral view of larvae of *E. sub-baculifera*, sp. nov. 6, Cephalic protuberance enlarged, and lateral processes, of *E. sub-baculifera*. 7, Lateral processes of *E. robusta*. 8, Ventral view of larva of *E. albolineata*, variety. 9, Lateral processes of *E. albolineata*, Ckll. ("A" in all diagrams indicates a node of the abdominal segments.)

subobsolete line, or it may fail altogether, leaving the "face" entirely black. The larvae lack the distinctive thoracic appendages of *E. hamulata*, and have only a few short nodes on the segments. The dark mass of stercoral debris in the larval mesenteron is more evident in this species, and this is significant, for Rodd's specimens, collected in July, had several larvae of all ages feeding together on the one communal, rather crumbly pollen-mass.

This is in sharp contrast to the progressive feeding habits of *E. hamulata*, and brings *angophorae* closer to the habit of certain other wild bees, and so establishes the second parallel with Brauns's African *Allodape*.

The African *Allodape* construct nests in tubes excavated in stems, favouring such plants as *Iris*, *Rosa*, *Aloe*, *Rubus*, *Amaryllis*, and many others where a suitable tube may be bored into the pithy interior. Strangely, *A. pringlei* Cam. prefers to excavate a shaft and gallery in the ground, and both sexes are present in the nests at night. There is not any sign of individual cells, or chambers, in the lumen of the tube, and, later, the larvae appear to hold on to the wall by the long pointed "tail" end, a feature and habit common to the larvae of all the *Exoneuræ* studied by the author.

Did I tell you that the eggs of *E. roddiana* are deposited, just inside the entrance to the tube, in a low spiral line? Well, the eggs of *E. angophorae* are deposited in a higgledy-piggledy mass at the base of the lumen, which measured 3.5 mm. in diameter. The length could not be ascertained, since the collector had broken the stem during his explorations.

The collector sends a note on the hatching: "I have a little information on the period of incubation of the eggs of *Exoneuræ*. On August 17, I took a female and a cluster of ten eggs from a stem of *Lantana*, and placed some of them in a gelatine capsule. These hatched between August 31 and September 6, during my absence from home."

That is a very long period compared with the three days for eggs of the honey-bee. Other collections of nests contained several pupae, but apart from the short "cobby" stature, do not present any prominent characteristics, for they are truly typical of the bees.

3. *E. baculifera* Ckll. (described from National Park, Queensland)
New record: Lindfield, October 5, 1946.

A series of females and larvae, which have a small cephalic node, but only the rudiment of a lateral appendage. In a stem of *Erythrina*.

4. *E. excavata* Ckll. (described from National Park, Queensland)
New record: Brooklyn, N.S.W., October 7, 1946.

A large series of typical females. The face is entirely black in both sexes. A description of the allotype is appended. In stems of *Lantana*. No larvae available for study.

ALLOTYPE (in collection of the author): Male—Length, 7.5 mm. Black, with red abdomen.

Head black, with much long black hair on the entirely black face, which is greatly constricted by the strong development of the large compound eyes; mandibles reddish apically.

Mesothorax shining, with much long black hair; scutella similar; metathorax with long smoky hair laterally; tegulae blackish, polished; tubercles blackish.

Abdomen dark-chestnut red, the two basal segments black, others with a wide blackish band, and much blackish hair.

Legs black, tibiae and tarsi red, anterior femora with long black hair, short black hair and some coppery-coloured on others. Nervures and pterostigma reddish.

5. *E. hamulata* Ckll. (widely distributed over eastern Australia)

New record: Brooklyn, N.S.W., October 7, 1946.

A series of females and larvae typical in all characters, the latter exactly as in the Victorian specimens illustrated recently (q.v. Part III, *Victorian Naturalist*, July 1946). Three of the appendages bear prominent "fingers." Segments 8-9 lack nodes. In stems of *Lantana*.

In a second series, from the same locality, the larvae lack the appendages, but a note of warning to taxonomists should be sounded here—the larvae should be fully developed for the appendages to be studied critically, as they do not appear in the very young, and are completely absorbed as metamorphosis approaches.

6. *E. robusta* Ckll. (described from National Park, Queensland)

New record: Lindfield, October 5, 1946.

A series of females and larvae, which have the three lateral appendages very like those of *E. hamulata*, to which they are indeed close. The face-marks are variable as noted by Cockerell. The legs of these are redder than the type. In stems of *Spartium junceum*.

Changing the Loaf of Bread

In an endeavour to ascertain whether or not the larvae of *E. angophorae* could survive on pollen, without any progressive feeding of regurgitated "pap" by the mother, I removed the larvae from the care of the adults, and transferred them to a pudding of pollen taken from a comb of the honey-bees. The quality and quantity of the food was thus considerably altered.

Working on the rule that one cell of pollen is sufficient to produce one adult bee, two cells were emptied. The store was a very mixed one, for it consisted of many spherical, spiky, orange-coloured granules of *Cryptostemma*; a number of larger triangular grains of *Eucalyptus*; numerous smaller triangular ones, and many spherical creamy-coloured granules from some unknown species, but probably cultivated fruit-trees; also a number of white elliptical

grains. The pollen was worked up into a moist cake with honey and the larvae transferred to it with a sable-hair pencil, apparently without injury.

How do I know that?

I accept as a general law in biology that an animal's interest in food diminishes according to the gravity of the injury sustained. Well, the larvae immediately buried their mandibulae in the food, and ate avidly. That was at 2 p.m. on a Wednesday.

Observed under the microscope, by transmitted light, the mandibles were seen to be biting off large "mouthfuls" of the orange-coloured food, which could be traced passing along the oesophagus to the mesenteron. A copious flow of some colourless secretion could be seen issuing from the mouth, forming numbers of microscopic bubbles, and mixing with the store as each larva continued its meal.

From six to eight "mouthfuls" were swallowed in quick succession and then the creatures rested for several minutes before resuming. All ate the strange food with evident relish. At 10 p.m. on the following Friday, they were still vigorous; that is, they had been feeding with hearty appetites for 56 hours. Unfortunately, later in the night, the larvae "crawled" out of the wooden container, and could not be found, thus bringing the experiment to an unsatisfactory conclusion. However, it is hoped to have better success when more larvae are again available. It was very evident that the legless larvae could move from place to place.

I returned to Sandringham on July 8, 1946, after having visited the sandstone gully at Lane Cove exactly a month before. In my bags was a number of dry twigs of *Acacia* containing the "nests" of various *Exonewae*. Unfortunately, a serious illness in the family intervened, and I could not examine the twigs until early in September.

The sticks were enclosed in a tight box, so imagine my astonishment when, 90 days later, I opened the box, and discovered several adults and larvae still alive and well! All were positively without food during that long interval. I accept, then, Norman Rodd's observation that the *Exonewae* are capable of surviving long periods of abstinence.

There is a third group of *Exonewae*, as I had anticipated, where each larva receives its own individual pollen-pudding. These species establish beyond all doubt the third true and surprising parallel with Brauns's African *Allodape*. In a letter just to hand, Rodd says: "I have recently opened a stick-nest of *E. roddiana* Raym., and found that each larva was supplied with a substantial individual pollen-pudding held in the ventral curve of the abdomen. The several specimens now sent to you contained varying amounts of pollen-stores, either communal or individual, according to how the larvae were disposed in the tube."